

MISSOURI Natural Areas

N E W S L E T T E R

2011
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...identifying, designating, managing and restoring the best remaining examples of natural communities and geological sites encompassing the full spectrum of Missouri's natural heritage"

2011 International Year of the Forest

This is the year of the forest, said the United Nations General Assembly when they declared 2011 as the International Year of Forests to raise awareness on sustainable management, conservation and sustainable development of all forest types. On the global scale, our wooded natural communities in Missouri are typically considered mainly "forests" when using international vegetation classification systems. In Missouri, ecologists differentiate between savanna, woodland and forest natural communities. While ecologists agree that Missouri is technically more "woodland" than "forest," we are speaking in the broadest and most international way when we salute and pay homage to our Missouri forests.

Internationally, forests face some of the same threats as they do in Missouri. Unsustainable harvesting, land conversion, invasive species, fire suppression, wildlife population imbalances (e.g., deer), pollution and climate change are factors that can adversely affect the health of a forest here and on a very large scale in other countries. The good news is, through assessments, evaluations and sound strategies, we have an understanding of the work that is needed to conserve and sustain Missouri's forests and measures of our successes thus far. Forest conservation, like all conservation, means working together with many stakeholders and partners to find reasonable solutions that work well for everyone.

In this issue, we talk about the collaboration and cooperation that takes place in Missouri. It's important that it happens here, nationally and internationally, as we know that we are all connected in this world.

We also examine the contributions that Missouri's wooded natural communities make to our lives, the rich array of terrestrial and aquatic species that help create balance in our natural areas, as well as their undeniable contribution to clean air and water through carbon sequestration. We talk about the link between healthy forests and healthy water. We also look at the importance of creating a sustainable economic environment in the human communities where Missouri forests are located. It is vital that the forest provides benefits to all citizens, ranging from economic gain through sustainable harvesting of trees to the recreational enjoyment from camping, birding or hunting.

Many thanks to the impressive group of writers and contributors to this Missouri Natural Area Newsletter. Readers are encouraged to contact them with questions.

— Elizabeth Niven, editor



While this newsletter discusses natural area management, it is important to remember that natural areas are, themselves, "tools" for natural community and ecosystem management.

In Missouri, most of the state's 180 designated Missouri Natural Areas (dots on map) are at the core of Missouri's Conservation Opportunity Areas (shaded areas on map)—landscapes determined to be the best remaining places to conserve and restore biodiversity on a viable scale to carry out Missouri's Comprehensive Wildlife Strategy. Missouri Natural Areas are reservoirs of species diversity, serving as reference points for managers and restoration biologists as they seek to improve natural landscapes to benefit both people and natural diversity.



Missouri Department
of Natural Resources



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Missouri's Forest Resource Assessment and Strategy

A Scorecard for Missouri's Forests

By Steve Westin and Gus Raeker

Missouri's landscape includes an impressive 15.4 million acres of forest land making up 35 percent of Missouri's total acreage. We also have an extensive urban forest network of street, yard and park trees. These forest resources come in a wide assortment of sizes, shapes and ownerships, which collectively provide extensive benefits we all depend on: clean water and air, protection of soil, forest products, wildlife habitat, recreational opportunities, aesthetics and much more.

Periodic assessment of our forest resources, and the influences affecting them, allows Missourians to engage in strategic planning to help ensure that these benefits are sustained and enhanced for present and future generations. Such planning is especially important now because:

- 1) Missouri's forest resources are facing serious threats from stressors such as exotic species, fragmentation, and poor harvesting practices;
- 2) Missouri's forest resources offer untapped potential to address some of our most pressing social and environmental challenges; and
- 3) The current financial climate makes it especially critical that limited financial resources are invested into projects, which will provide the greatest impact, and that collaborative partnerships and synergies are fully utilized.

The 2008 Farm Bill recognized the need for forest planning by requiring states to complete a statewide forest resource assessment and develop strategies to address issues identified in the assessment in order to continue receiving federal funds through the Cooperative Forestry Assistance Act. In response, the Missouri Department of Conservation (MDC) has collaboratively developed Missouri's Forest Resource Assessment and Strategy (FRAS) with help from more than 40 partner organizations.

The assessment identifies Desired Future Conditions (DFCs) for Missouri's forest resources, key threats and opportunities, which impact the ability to achieve these DFCs, and priority geographies for focusing limited resources. Subsequently, the strategy details how MDC and partners intend to use limited existing resources to address assessment findings, and leverage additional resources.

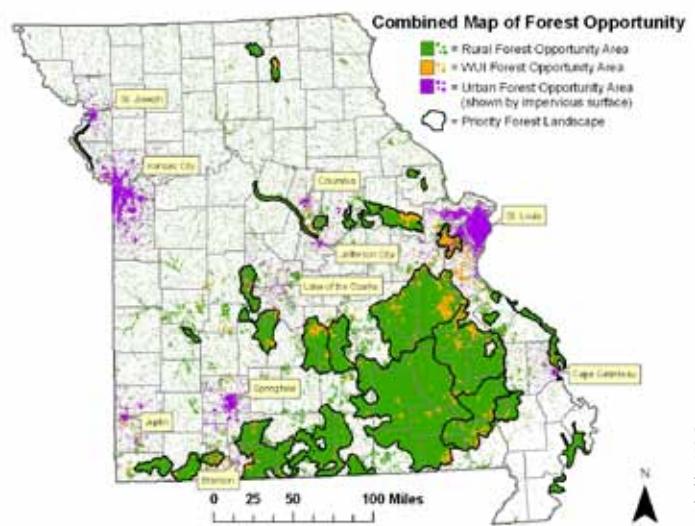
The scope of FRAS includes all land ownerships, both public and private. FRAS uses "forest" in the broadest of senses, including all forest and woodland natural communities, rural and urban settings, and everything from the largest patch of forest in the Ozarks to individual city street trees.

The FRAS Process:

In the assessment, 11 key issues/themes were identified to organize and describe the threats and opportunities facing Missouri's forest resources.

1. Private Forest Landowner Demographic Trends and Corresponding Land Use Changes
2. Challenges and Opportunities for Private Forest Landowners
3. Climate Change
4. Maintaining High Quality Soil and Water Resources
5. The Role of Fire in Missouri's Forests
6. Missouri's Growth, Harvest and Consumption of Forest Products
7. Forest Health Threats: Plants, Animals, Diseases and Weather
8. The Role of Trees in Improving Quality of Life and Sustainability in Cities
9. Public Lands Which are Managed for the Greatest Public Good
10. Maintaining Biodiversity
11. Logistical Framework for Sustainability

DFCs were established for each issue/theme to help describe the issues and provide direction for the strategy. Conditions, trends, threats and opportunities were researched and summarized. From there, Forest Opportunity Areas (FOAs) were established for focusing limited forestry financial resources to achieve FRAS objectives. In Rural/Wildland Urban Interface areas, FOAs generally include areas that offer the greatest current or potential benefits from forests, which are also vulnerable to stressors that we can positively influence. Urban FOAs include areas with the greatest concentrations of people and impervious surfaces.



Assessment findings were used to develop a list of 77 individual strategies to best achieve DFCs.

Once this list of strategies was developed, a strategy matrix was created to provide the following for individual strategies: example action items, target geographies, issue themes and DFCs supported, criterion and indicators supported, national priorities, objectives and performance measures supported, key potential stakeholders, resources needed, and measures of success.

The strategy matrix shows all stakeholders where they intersect, have common purpose, and where they can pool resources to insure success of the plan.

Missouri's Forest Resource Assessment and Strategy is an immense resource for people interested in Missouri's forests and land management issues.

The full FRAS report is available on MDC's web site at: http://mdc.mo.gov/sites/default/files/resources/2010/08/9437_6407.pdf.

Here are a few interesting facts that were included in the report that helped create our management strategies and conservation efforts going forward:

Did you know?

- 82 percent of Missouri's forest land is privately owned. Therefore, the future sustainability of Missouri's forests rests largely in the hands of private landowners and the management decisions they make. And, 17 percent of Missouri's family forest land is owned by people 75 years of age or older, and ~70 percent is owned by people 55 years of age or older (1). Accordingly, Missouri is seeing a lot of forest land changing hands. These transitions can often put forest land at greater vulnerability to conversion to other uses (e.g., pasture, development), fragmentation and parcelization.
- Approximately 10 percent of Missouri's family forest owners utilize assistance from a professional forester (1). Foresters play a key role in helping landowners make and implement sustainable forest management decisions. One key to enhancing the future sustainability of our forests will be to increase landowner access to and knowledge of professional forestry services.
- According to the U.S. Forest Service Climate Stress Index, Missouri is one of the most vulnerable states in the U.S. to projected changes in climate (2). With four distinct ecological sections in Missouri (Central Dissected Till Plains, Osage Plains, Ozark Highlands and Mississippi Alluvial Basin), the range of many species of flora and fauna begins or ends in Missouri. Species at the edge of their range can be especially susceptible to changes in climate.
- Missouri's forests currently store approximately 844 million tons of carbon, and growing (3). This underscores the importance of forests for sequestering carbon dioxide,

but also reveals how important it is that we maintain forest health. A wide-scale die-off of trees in Missouri would release a large amount of carbon dioxide into the atmosphere.

- According to the U.S. Forest Service's *Forests, Water and People Assessment*, Missouri's Meramec watershed and Lower Missouri River watershed are the two most important watersheds in a seven-state area for working to keep forests intact to protect water quality (4). The Meramec watershed, for example, provides high quality, relatively inexpensive drinking water to about 210,000 people – largely due to forest cover – and provides habitat to a tremendous diversity of aquatic species. However, this watershed is also one of the most vulnerable to future development pressure. FRAS strategies seek to keep this important resource intact.
- From 1989-2008 there was an approximate 600,000-acre increase in forest land containing at least 10 square feet basal area of sugar maple – attributed largely to the removal of wildfire from many natural communities (3). Although sugar maple are very attractive in the fall, the encroachment of maple into oak/hickory forests and woodlands can have highly detrimental impacts on the diversity of flora and fauna.
- From 2003-2008, Missouri's forests have grown significantly more dense in basal area (3). This trend results in trees that grow slowly due to competition, produce less mast than they would with more elbow room and are more susceptible to insect and disease threats. Crowded forests also allow less sunlight to penetrate to the forest floor, and consequently have less herbaceous vegetation, which is important to many wildlife species. ☀

1 Butler, B.J. 2008. Family Forest Owners of the United States, 2006. Gen. Tech. Rep. NRS-27. Newtown Square, PA: U.S. Dept. of Agriculture, Forest Service, Northern Research Station.

2 U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Research Station – Wildlife Habitat Policy Research Program. 2009. Climate Change Stress Index (as presented by Linda Joyce on February, 2009 at the Missouri Natural Resources Conference).

3 U.S.D.A. Forest Service – Northern Research Station – Forest Inventory and Analysis Data.

4 Barnes, M.C., A.H. Todd, R. Whitney Lilja, and P.K. Barten. 2009. *Forests, Water and People: Drinking water supply and forest lands in the Northeast and Midwest United States*. Newtown Square, PA: U.S. Dept. of Agriculture, Forest Service, Northeastern Area State and Private Forestry.

Steve Westin has been a forester with the Missouri Department of Conservation for 21 years in a variety of capacities. Most recently, he has served as MDC's forestry private lands program supervisor, and is now program supervisor for Planning and Emerging Issues.

Gus Raeker has been a forester with the Missouri Department of Conservation for 12 years. Most of this time, he served as a resource forester at the Missouri River Hills COA. From 2008-10, he took a hiatus from his normal duties to spearhead development of Missouri's Forest Resource Assessment and Strategy. He is now a district forest supervisor working in the St. Louis Region.

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Additional resources: The September 2010 issue of the *Missouri Conservationist* magazine was devoted to Missouri's forests. The magazine is available electronically at: <http://mdc.mo.gov/conmag/2010/09>

Three New Natural Area Designations

Linking Healthy Forests and Streams

By Mike Leahy

A tenet of stream management is that a stream is a product of its watershed. So if the lands of a watershed are healthy, then the aquatic communities found in the watershed's streams will be. This spring, three new natural-area designations highlight the importance and role of healthy watersheds in defining high-quality stream communities. Research has demonstrated that streams fed by watersheds with extensive impervious surfaces (e.g., pavement, buildings) or row-crop agriculture typically have diminished aquatic fauna. Healthy streams have intact riparian corridors, watersheds dominated by native vegetation, low inputs of pollutants (both organic and inorganic), and relatively stable channels. Unfortunately, many streams in Missouri don't retain these characteristics.

Below are highlighted three recent natural-area designations that provide good benchmarks of stream and land health. These natural areas also exemplify the issues involved with protecting aquatic natural communities. Factors outside of the designated natural area boundary have disproportionately larger impacts to the aquatic natural communities of these sites than to their terrestrial counterparts. Conserving streams can be tough, but is essential given the importance of water quality to outdoor recreation and the vast and often underappreciated native aquatic fauna of the state.

LABARQUE CREEK NATURAL AREA – a 639-acre natural area in Jefferson County that includes a mile of frontage along LaBarque Creek. The creek supports 36 native fish species (including five native darters), ranking it as the highest in diversity of native fishes found in tributaries to the Meramec River in Jefferson and St. Louis counties. It is the last high-quality stream remaining in the St. Louis metro area. Two



Mike Leahy, Missouri Department of Conservation

LaBarque Creek Natural Area

miles of intermittent and perennial headwater streams course through the natural area, many cascading through sandstone canyons and chutes, before entering LaBarque Creek.

The LaBarque Creek watershed of 13 square miles is 86 percent forested. Approximately 29 percent of the watershed is publicly owned. Currently, less than 5 percent of the watershed consists of impervious surfaces (Meneau 2008). LaBarque Creek supports populations of the rainbow darter, bleeding shiner, Ozark minnow and the southern redbelly dace. All of these fishes are characteristic of clear, small Ozark streams (Pflieger 1997).

In addition to its aquatic features, the natural area supports a wide variety of terrestrial natural communities, including more rare communities such as sandstone cliffs, glades, woodlands and forests. All told, almost 500 vascular plant species and 115 bryophyte species (liverworts and mosses) have been documented on the area. The diverse habitats of the area support nearly 50 breeding bird species too. This natural area is a centerpiece of the larger LaBarque Creek Conservation Opportunity Area identified as part of the Missouri Comprehensive Wildlife Strategy (see <http://mdc.mo.gov>).



Jim Ritter, Missouri Department of Conservation

The bleeding shiner is found at the LaBarque Creek Natural Area.

mo.gov/landwater-care/priority-focus-areas/
conservation-opportunity-areas).

To access LaBarque Creek Natural Area: from Eureka, Missouri, take Highway 109 south to Route FF, then west to Route F, then south approximately 100 feet, then west on Doc Sargent Road, then about 0.5 mile to Valley Drive, and south to the parking lot. The area features a three-mile loop hiking trail.

Contact 636-441-4554 for more information. See http://extra.mdc.mo.gov/documents/area_brochures/200608map.pdf for a downloadable map. The area is owned and managed by the Missouri Department of Conservation (MDC).

LITTLE NIANGUA RIVER NATURAL AREA
— a 240-acre natural area in Camden County that lies within Burnt Mill Cave Conservation Area. This site features more than a half mile of the Little Niangua River, its associated riparian corridor and adjacent bluffs, woodlands and glade natural communities. This stretch of the Little Niangua River provides excellent habitat for the Niangua darter (*Etheostoma nianguae*), which is listed as threatened by the U.S. Fish & Wildlife Service. The Niangua darter, along with the Missouri saddled darter (*Etheostoma tetrazonum*) ply the waters of the Little Niangua River. Both fishes share the distinction of being endemic to Missouri.

Another feature of the natural area is Lower Burnt Mill Cave, which is currently a maternity cave for the gray bat, listed as endangered by the U.S. Fish & Wildlife Service. The presence of the Niangua darter and the gray bat, both species listed



Mike Leahy, Missouri Department of Conservation

Little Niangua River Natural Area

which less than 1 percent is row crop, 30 percent is grassland (mainly fescue pasture), 64 percent is wooded, 4 percent is developed lands (impervious) and 1 percent is water (CARES 2010). A series of riffles, pools, runs and gravel bars on the Little Niangua River provide high-quality habitat for the nine darter species found here. The ellipse mussel found in the river uses the rainbow darter, fantail darter, Johnny darter and logperch – all fishes found here – as hosts for its larvae (*glochidia*).

Thankfully the hard work of Craig Fuller, Greg Stonner, and Doug Novinger of MDC, as well as staff from the U.S. Fish & Wildlife Service and the Missouri Department of Natural Resources, has resulted in the replacement of many low-water road crossings that acted as fish-passage barriers along the Little Niangua River with clear-span road crossings that allow for the free movement of fish upstream and downstream, including Niangua darters. To date, seven low-water crossings have been replaced with clear-span crossings. There are now 42 miles of unimpeded habitat along the Little Niangua River, including upstream and downstream of the natural area.

To access Little Niangua River Natural Area: from Highway 54 at Macks Creek, Missouri, go north on Route N, five miles to Kolb Hollow Road. Then head east (right) on Kolb Hollow Road 3.2 miles to the parking area on the south side of the road. An old road provides an access trail to the bluffs above the river. Alternatively a canoe float can provide access by putting in upstream of the natural area at Howard's Ford.

Contact 573-346-2210 for more information. For a downloadable map see http://extra.mdc.mo.gov/documents/area_brochures/200902map.pdf. The area is owned and managed by the Missouri Department of Conservation.



Jim Rathert, Missouri Department of Conservation

The Niangua darter is found in the Little Niangua River.

under the U.S. Endangered Species Act, provided funding through the U.S. Fish & Wildlife Service to purchase this site in 2009 to assist with the recovery of these endangered species.

The Little Niangua River watershed is 320 square miles, of

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Three New Natural Areas: continued from page 5

SPRING'S END FOREST NATURAL AREA – a 417-acre natural area in Crawford and Phelps counties that lies within the larger Woodson K. Woods Memorial Conservation Area. In 1972, the original 15-acre Spring's End Forest Natural Area was designated to conserve an old-growth stand of mesic bottomland and riverfront forest. Thirty-eight years later, the Missouri Natural Areas Committee recognized the importance of expanding this natural area by 402 acres to encompass a high-quality floodplain site. It includes the original old-growth stand of bottomland forest along with 300 acres of additional good quality mesic bottomland and riverfront forest that stretches bluff to bluff on both sides of the Meramec River.

This riverine system of gravel and sand bars, sloughs, riverfront forest and mesic bottomland forest is the largest intact site along the middle section of the Meramec River. Most other bottomlands have been cleared for agriculture. This natural area is a good reference site for restoration efforts in the larger Middle Meramec Conservation Opportunity Area identified as part of the Missouri Comprehensive Wildlife

Spring's End Forest Natural Area



Mike Leahy, Missouri Department of Conservation



Jim Rathert, Missouri Department of Conservation

The American redstart is found at Spring's End Forest Natural Area.

Strategy (see <http://mdc.mo.gov/landwater-care/priority-focus-areas/conservation-opportunity-areas>).

The Meramec River, in this location with its hydrologic cycles, is an integral factor in shaping the development of the riverine natural communities of the natural area. Although non-native trout are stocked upstream of the natural area at Meramec Spring Park, the river here contains a rich fish and crayfish fauna, including six Ozark-endemic fishes and three Ozark-endemic crayfishes – all indicative of good water quality. These include the Meramec saddled darter, freckled crayfish and saddlebacked crayfish, all of which have a global distribution restricted to Missouri! The state-endangered eastern hellbender has also been documented in this stretch of the Meramec. The Meramec River at Spring's End Forest Natural Area is fed by the upper Meramec River and Dry Fork watersheds, covering 729 square miles (CARES 2010).

The river's flow is also greatly enhanced by the discharge of Meramec Spring, which has a recharge area of 310 square miles (all within the Dry Fork watershed). The land use/land cover of the upper Meramec River and Dry Fork watersheds combined is 65 percent forest, 29 percent grassland (mainly fescue pasture), 5 percent developed, and less than 1 percent each of cropland and surface water (CARES 2010). These land-cover/land-use values for cropland and impervious cover are well below thresholds for watershed degradation identified by Wang et al. (2002).

The Audubon Society has designated this and the surrounding area as an "Important Bird Area" (noted as #46-Upper/Middle Meramec River Watershed) addressing the needs of cerulean warblers, bald eagles, prothonotary warblers, and other forest interior birds (National Audubon Society 2009). During the breeding season, the cerulean warbler, northern parula, prothonotary warbler, red-eyed vireo, American redstart, wood duck, pileated woodpecker, Acadian flycatcher, Kentucky warbler and the Louisiana waterthrush have all been observed here. In addition two great blue heron

(Three New Natural Areas: continue on page 7)

The Green Menace lurking in Missouri

Emerald ash borer has been discovered

By Joanie Straub

Since 2008, when this half-inch green menace, the emerald ash borer (EAB) was first discovered at the U.S. Army Corps of Engineers' Greenville Recreation Area in Wayne County, Missouri, the hunt has been on.

EAB is an exotic, invasive, wood-boring beetle that infests and kills native North American ash trees in both forests and landscape plantings. Although the EAB can fly short distances on its own (1-2 miles), much of its spread is due to humans transporting it as larvae burrowed under the bark of firewood or landscape trees. Adult females lay their eggs on the bark of ash trees. When the eggs hatch, the larvae burrow under the bark and eat the living tissue they find there. As they do, they cut off the life-giving channels that carry nutrients—water and sugars—to the tree. After 2 - 4 years, enough of the channels are cut off so that the tree starves to death.

If there are ash trees in the vicinity, then EAB will move on to the next ash tree, lay its eggs and start the cycle again.

The borer, which is native to China and probably arrived in



MDC

Emerald Ash Borer

the United States in packing crates, was first found near Detroit in 2002. So far, it has killed an estimated 50 - 100 million ash trees in 15 states and two Canadian provinces.

Similar to chestnut blight and Dutch elm disease, EAB is capable of eliminating an entire tree species from forests and cities. To put its damage in perspective, the number of chestnuts killed by chestnut blight was around 3.5 billion chestnut trees. Dutch elm disease killed a mere 200 million elm trees, while EAB threatens 7.5 billion ash trees in the U.S.

Past invasive tree pests have only threatened a single species within a genus. But EAB threatens the entire North

(*Emerald Ash Borer: continue on page 8*)

Three New Natural Areas: continued from page 6

colonies are located in the natural area.

To access Spring's End Forest Natural Area: from St. James, travel south and east on Highway 8. From the intersection of Highways 8 and 68, proceed east on Highway 8 for ¾ mile and turn left (north) into the area parking lot. Follow the main area access road (which may be closed to vehicle traffic) for about 2 miles to the north end of the natural area (consult the area map for details, available at http://extra.mdc.mo.gov/documents/area_brochures/7103map.pdf).

However, the easiest way to access the largest portion of the natural area is via canoe. From the intersection of Highways 8 and 68, go east on Highway 8 for about 3.75 miles (crossing over the Meramec River bridge) and turn left (north) into the access lane that leads to the Meramec River access within a tenth of a mile. From the river access, it is about 2 river miles downstream to the entrance of the natural area. After canoeing for 2.5 miles through the natural area, Scotts Ford Access is 4 miles downstream of the east end of the natural area and is the first take-out point. The above float makes for an 8.5 to 9-mile canoe trip from the river access on Woodson K. Woods Memorial Conservation Area to Scotts Ford Access.

Contact 573-368-2225 for more information. The natural area is owned and managed by the Missouri Department of Conservation. 

Mike Leahy is a natural areas coordinator for the Missouri Department of Conservation.

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References:

- CARES. 2010. Watershed Evaluation and Comparison Tool. University of Missouri Center for Applied Research and Environmental Systems. <http://ims.missouri.edu/website/watershedtool/>
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- Pflieger, W.L. 1997. *The fishes of Missouri*. Missouri Department of Conservation, Jefferson City.
- Wang, L., J. Lyons, P. Kanehl, R. Bannerman, and E. Emmons. 2002. *Watershed urbanization and changes in fish communities in southeastern Wisconsin streams*. Journal of the American Water Resources Association 36: 1173-1189.

Emerald Ash Borer: continued from page 7

American *Fraxinus* genus, which includes white, green, black, pumpkin and purple ash. The EAB infests trees ranging in size from saplings to fully mature trees. While most native borers kill only severely weakened trees, emerald ash borer kills healthy trees as well, making it especially devastating. Prior to the arrival of EAB, ash was one of the most important nursery and landscape species in the United States. This makes EAB one of the most serious environmental threats now facing North American forests.

Scientists and environmentalists have been unable to stop the beetle, only slow it down. A U.S. Department of Agriculture study estimated the damage from the borer would cost \$10.7 billion by 2019, if the spread reaches 25 states. That's based on the assumption that the beetles will infect 17 million landscaped ash trees in that 25-state area. Just to put it in perspective, nearly 114 million board feet (33,000 cubic meters) of ash saw timber with a value of \$25.1 billion is grown in the eastern United States each year. Additionally, many products are made from ash wood: guitars, furniture and baseball bats.

With EAB in the Show-Me State—and its ability to hitchhike on firewood—the probability of it spreading to other areas in the state is moderate to high. It is expected that EAB will diminish ash trees in Missouri's forests to a very low level.

Ash trees account for 3 percent of Missouri's native forest. The fast-growing shade trees are popular for landscaping, though, and about 14 percent of trees lining streets in urban settings are ash. In some neighborhoods and parks, the figure reaches as high as 30 or 40 percent.

EAB is not a "business as usual" tree pest. It kills quickly and thoroughly. If left unchecked, EAB will destroy Missouri's ash trees and the many quality-of-life benefits they provide: shade, wildlife habitat and contributing to air and water quality. ☀

Joanie Straub graduated from the University of Missouri with degrees in broadcast journalism and history, and received her master's in technical communications from Colorado State University. Since 2004, Straub has been an independent marketing communications consultant working with state governments and agencies on environmental causes. She was recently hired by the Missouri Department of Agriculture to be Missouri's Emerald Ash Borer outreach coordinator.

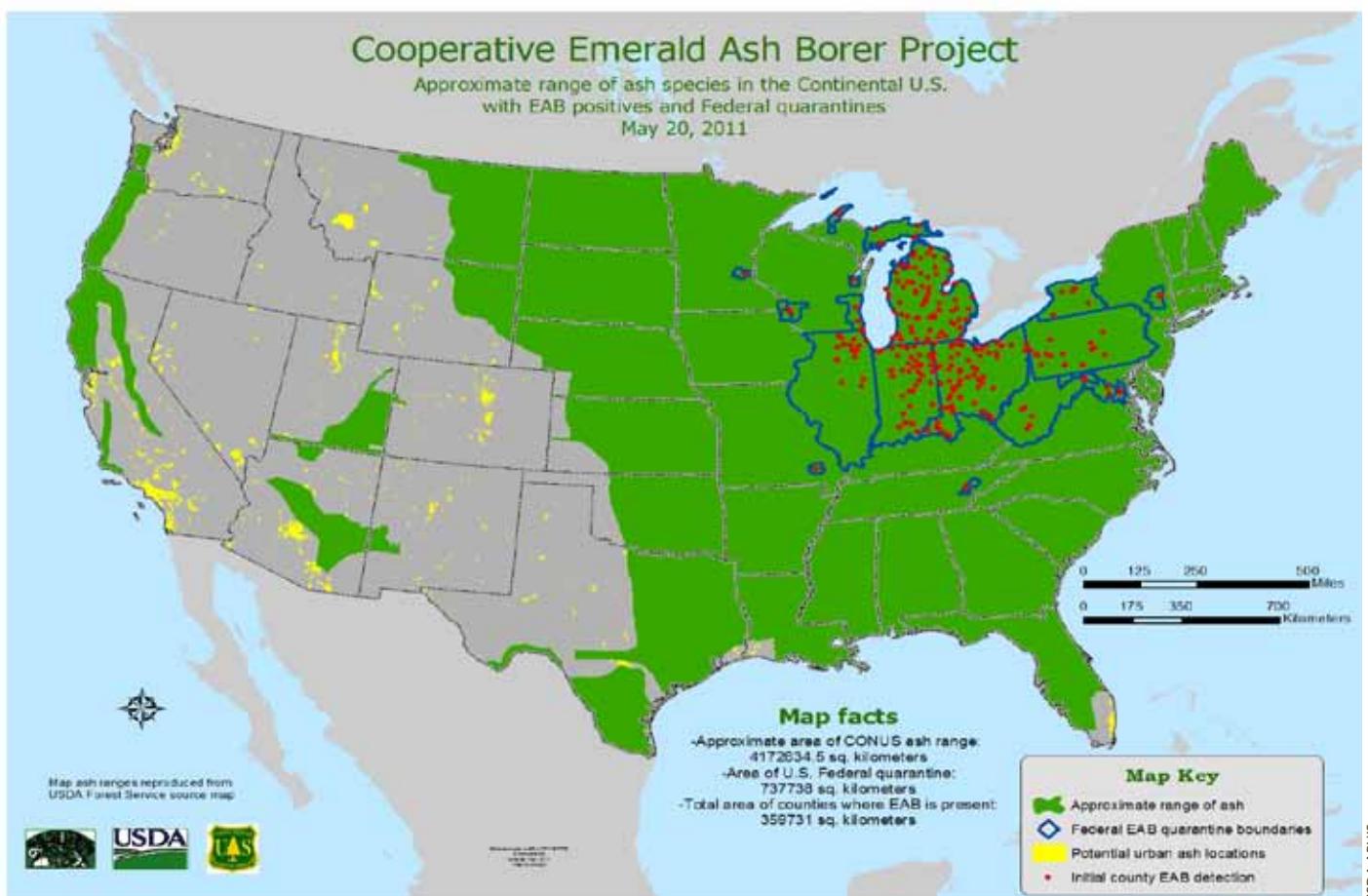
Contact: Joanie Straub, Missouri Emerald Ash Borer Outreach Coordinator, 2901 West Truman Blvd, P.O. Box 180, Jefferson City, MO 65102, joanie.straub@mdc.mo.gov, 573-522-4115, ext. 3595.

Additional resources:

To sign up for the quarterly newsletter, *Borer Bites*, that gives information about EAB in Missouri, send an e-mail to: joanie.straub@mdc.mo.gov

Missouri cooperative website: www.eab.missouri.edu

National website: www.emeraldashborer.info



Thousand Cankers Disease (TCD):

A new threat to Missouri walnuts

By Simeon Wright

Since the 1990s, black walnut trees have had an unusual decline in several western states. In 2008, an insect/disease complex was identified as the culprit: the activity of the walnut twig beetle, *Pityophthorus juglandis*, transports spores of a canker-producing fungus, *Geosmithia morbida*, causing walnut decline and mortality.

The name "thousand cankers" comes from the numerous cankers, or infected tissue, surrounding multiple beetle entry points on branches and main stems. As cankers expand and coalesce, the tree becomes unable to store and move nutrients, which weakens and eventually kills the tree after several years. Currently, no effective controls have been identified to successfully control TCD once it is established.

TCD only affects walnut species. Symptoms include midsummer yellowing and wilting of leaves on limbs high in the crown, leading to limb die-back, usually from the top down. As the disease progresses and limbs are killed, new sprouts may grow from the roots or trunk prior to tree death. Removing bark from dying limbs 1-2 inches in diameter would expose dark brown cankers around beetle tunnels.

Eight western states (Washington, Oregon, Idaho, California, Utah, Arizona, Colorado and New Mexico) and Tennessee are known to have TCD. While the rate of natural spread of this disease is expected to be slow, probably less than 2 miles/year, this disease may be transported to other locations on TCD-infected walnut materials in a day. A Missouri state quarantine has been imposed to keep TCD out of Missouri and bans untreated walnut logs, walnut wood, all hardwood firewood, walnut nursery stock and walnut scionwood from entering Missouri from states where TCD has been detected.

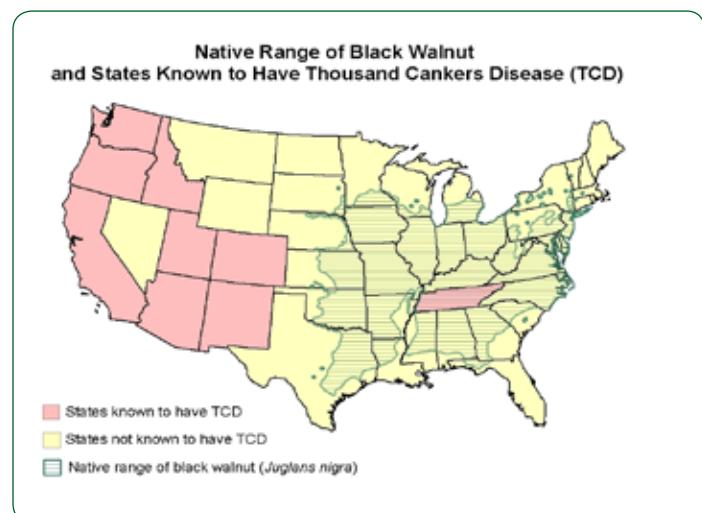
Across Missouri, Missouri Department of Conservation and Missouri Department of Agriculture staff and trained volunteers are conducting visual surveys looking for TCD. High-risk sites, like urban areas, campgrounds and sawmills where TCD-infected wood from TCD-infected areas could be imported, are being monitored and area trees are being evaluated. Detection is based on observation of pockets of walnut trees displaying external symptoms and examination of branches from suspect trees for walnut twig beetles and *Geosmithia* cankers.

Think you might have detected walnut trees with TCD symptoms? Send photos of suspected trees or branches, including the entire tree, a close-up of leaves and any other visual symptoms and email it to: forest.health@mdc.mo.gov along with detailed location information. Or, report suspect



Simeon Wright, Missouri Department of Conservation

Walnut trees with TCD symptoms in Colorado



Map provided by MDC

trees to local MDC foresters. Do not send samples of suspect trees for examination and testing by plant diagnostic labs. Sufficient samples for testing are challenging to collect and procedures must be followed to ensure that TCD is not further spread in transport to the testing lab.

Simeon Wright is a forest pathologist for MDC. Previously, he directed the plant diagnostic clinic at the University of Missouri for more than five years. He earned a bachelor's in entomology from Iowa State University and a master's in plant pathology from The Ohio State University, a good combination for working on an insect/disease complex.

Contact: Simeon Wright, Simeon.Wright@mdc.mo.gov, 573-882-9909 ext. 3311.

Additional resources: Photos, additional information, and links to other TCD sites can be found at www.mdc.mo.gov/thousand-cankers.

Some additional websites (linked at the MDC website):
<http://mda.mo.gov/plants/pests/thousandcankers.php>
www.na.fs.fed.us/pubs/detail.cfm?id=5225
<http://snr.missouri.edu/forestry/extension/tcd.php>
www.colostate.edu/Dept/bspm/extension%20and%20outreach/thousand%20cankers.html

Seeing the Water Through the Forest

Making the link between water, land and people

By Preston Mabry

How are water quality and forest related? Why is this relationship important? What are the economic benefits of maintaining the health of Missouri's natural communities? How can we protect freshwater resources for local communities, while at the same time keeping our natural communities intact?

Every day, the staff at The Nature Conservancy examines these questions in an attempt to find practical, science-based solutions that will benefit both nature and people.

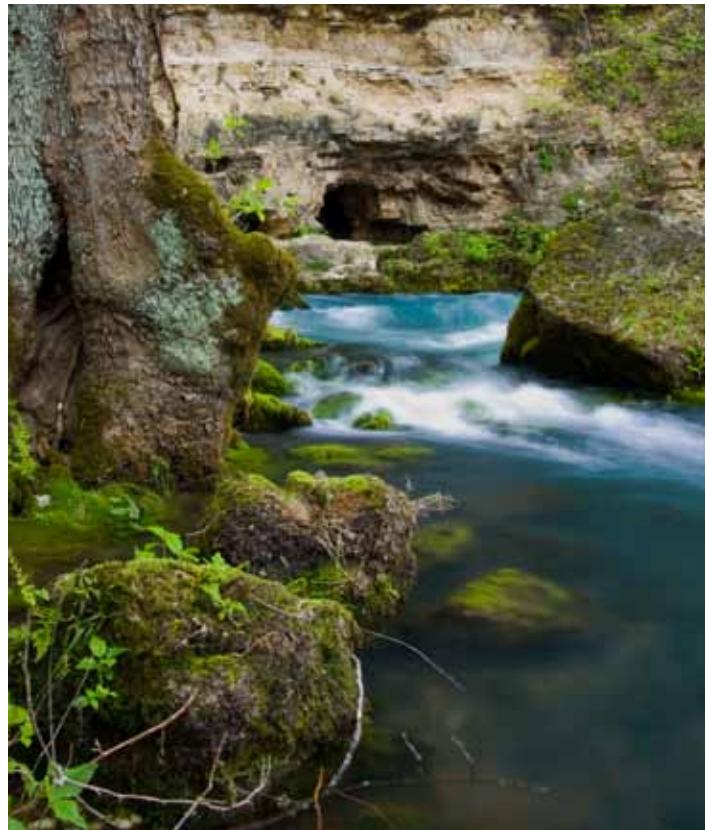
In the Current River region, the Conservancy has a long history of working to minimize threats and ensuring healthy forests and healthy waters. The Current River is one of the most significant middle-sized rivers in middle North America with 35 global priority aquatic species, 25 of which have their best or only populations on earth within the watershed. The aquatic biodiversity of the Current River watershed is a result of all of its components, from the upper terrestrial reaches, to the riparian zones, to the river itself.

Therefore, to protect and preserve the water quality and biodiversity of the Current River, the forest and woodland

View from Nature's Pace on the Current River



© Preston Mabry/TNC



© Bill Duncan/TNC

The Current River at Big Spring

within the Current River watershed must be protected. Healthy native forests and fire-adapted woodlands are characterized by an abundance of deep-rooted perennials that generate fertile, high carbon, high tilth soils. These soils are ideal for water absorption, preventing runoff by allowing even heavy rains to infiltrate the earth, thereby sustaining healthy aquifers and groundwater recharge.

These systems allow water to be released into the watershed at a measured rate, providing high-quality water even in dry periods. In contrast, surface water runoff from roads, poorly managed pastures, crop lands, and poorly managed woodlands is released in a destructive flush that promotes erosion, deprives the aquifer of recharge, and contains high amounts of sediment and other contaminants.

Excess sediment is one of the primary threats to Ozark streams, including the Current River. When water hits the Earth's surface, one of three processes may take place: evaporation, absorption, or runoff. When water falls on an impervious surface, it runs down to lowlands, gaining destructive energy and debris as it goes and ultimately dumping the contaminants into the streambed. This sedimentation chokes out habitats, which many aquatic species need to survive, and decreases the biodiversity of the river.

Other threats include nutrient loading from poorly managed pastures without stream corridor buffers, altered stream flows due to agricultural or commercial use, and unsustainable timber harvesting that does not follow the

state's best management practices.

In the early 1990s, the Conservancy purchased approximately 80,000 acres in the watershed from the Kerr-McGee Corporation. Much of the property was later transferred to the Missouri Department of Conservation for the benefit of all Missourians, and smaller portions were sold to private landowners with working forest conservation easements on them.

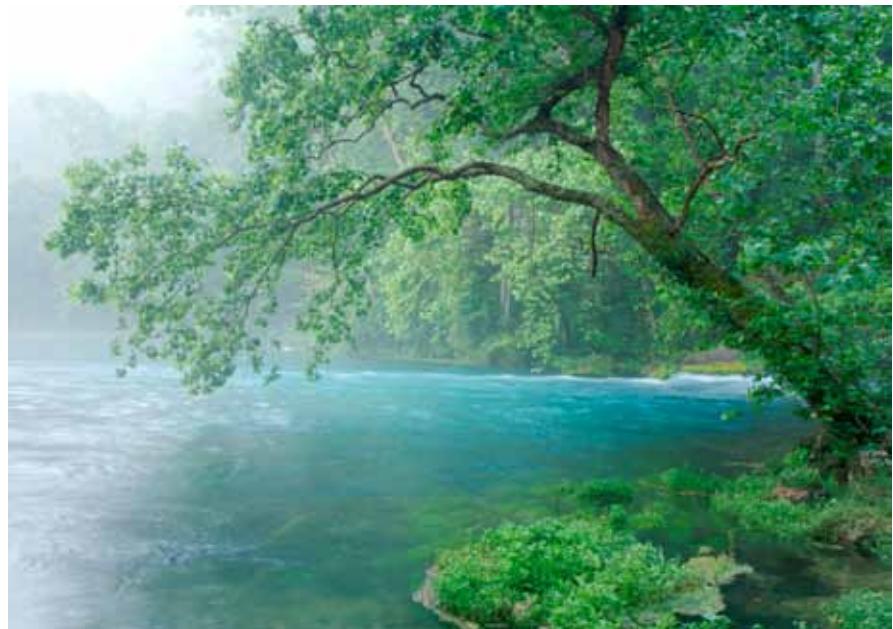
Working forest conservation easements are a significant tool for protecting forests and watersheds, while at the same time keeping properties in productive private landownership and sustaining the local economy and tax base. These easements and this approach typically allow the landowner limited development rights while promoting healthy forest management and compatible uses, such as sustainable forest product production, hunting and other activities.

This sustainable conservation not only deals with effective natural community management, but also ensures healthy economic and social systems that meet local human needs. This is important in the Current River watershed, where approximately 45 percent of the watershed is in private or public conservation ownership – a much higher percentage than most Missouri watersheds. In this rural region, forest products and tourism are two main drivers of the local economy.

The scope of the conservation work in the Current River watershed is enormous and the sense of urgency is profound. Currently, the watershed is 81 percent covered by native timber, 53 percent of which is protected. Studies reveal that stream degradation occurs below 65 percent native cover in the watershed. In addition, approximately 9 percent of the Current River watershed has been converted from native land cover to some other form since 1991.

The topography of the terrain is also important to the water quality. Slopes of 15 percent or greater, which make up roughly 11 percent of the Current River watershed, make land conversion more difficult. This could reduce the urgency of protection; however, if these lands were converted they would have a high impact on sediment input into the system.

A cooperative project by the Current and Eleven Point Conservation Opportunity Area working group, the Conservancy and the University of Missouri ranked private lands within the watershed based on forest cover, forestation of riparian zones, biodiversity, adjacency to other conservation lands and distance to roads. These data allow the Conservancy to identify and prioritize tracts based on the level of impact that conservation work would have on both terrestrial and aquatic landscapes.



The Current River immediately before Big Spring

© Byron Jorjorian

Currently, the Conservancy holds roughly 8,000 acres of working forest easements within the watershed, including a recent purchase (Nature's Pace, see photo bottom left) of 1.5 miles of Current River riverfront.

While this conservation approach focuses on reduction of sedimentation and nutrient inputs into the aquatic system, it has many terrestrial ecological benefits, including reduction of forest fragmentation and habitat loss. These and similar projects together will ensure the long-term health of the Current River system, while simultaneously preserving an optimum resource on which the local tourism and forestry industries depend.

The Current River watershed is a prime example of how economic and ecological issues are interlinked. The Conservancy's efforts will protect not only the natural communities of the watershed, but the local economy as well, demonstrating a win-win approach that will achieve conservation of the watershed while also meeting human and economic needs. 

Preston Mabry is the Current River project manager for The Nature Conservancy. He was raised near the Current River in Van Buren, where he has spent most of his life and currently lives. Prior to joining the Conservancy, Mabry worked as a conservation agent for the Missouri Department of Conservation.

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Additional resources:

Booth, D.B., D. Hartley and R. Jackson (2002). *Forest Cover, Impervious-Surface Area, and the Mitigation of Stormwater Impacts*. Journal of the American Waters Resources Association, 38: 835-845.

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Building from Scratch...at the Confluence

By Ken McCarty

Usually natural area managers are tasked with finding and preserving the best remaining examples of Missouri's outstanding native natural communities. Seldom are we asked to build one from bare ground.

But along Missouri's big rivers, levees separate water from the land through which it once flowed. Farms, homes, industry, urban or developed wetland and recreational lands fill those great expanses. No large natural wetland landscapes remain, and few wet prairie, marsh, shrub swamp, or mesic bottomland forest fragments persist in something approaching their natural state. So if we wish for functioning and diverse examples of rare natural systems, or want to increase their numbers and extent, bare ground is often where we must start.

And while it is simple to allow a suite of wetland plants such as willows, cottonwoods and silver maples to colonize a floodplain, fostering complex natural communities reminiscent of their native counterparts is the much more valuable and interesting challenge. That process begins by understanding the full array of native riparian plants and how they associate with all the different flooding patterns and physical environments.

The initial planning phase asked these questions: What is the terrain? What are the soils? From where does the water come and go, and for how long and when does it cover the ground at different elevations or saturate the ground? Then, what natural communities fit each of these situations? With good answers to these questions, the project is designed by matching the historic plants of particular combinations of soils and flooding patterns to sites having similar physical and hydrologic patterns. The final step is to facilitate the development of those plant communities along those physical and hydrological gradients, and continuing or emulating critical natural processes such as flooding and fire.

Natural areas and high-quality remnants are crucial to this process. While it is comparatively easy to map terrain and soils, or feasible to model a water regime, the kind of vegetation to expect or design is neither apparent nor well documented.

With so few high-quality examples left, natural areas like Westport Island, Prairie and Pin Oak Slough, Horton and Marmaton River Bottoms, Locust Creek, Oumissourit and Little Bean Marsh are essential to teach us about floodplain natural communities and ecology. They also model plant distribution and species composition, and in some cases serve as a source



Missouri Department of Natural Resources file photo

Edward "Ted" and Pat Jones - Confluence Point State Park in 2000. The muddy waters of the Missouri River enters the Mississippi River from the left. The state park is the expanse of plowed ground between the rivers.

for rare or uncommon plant materials.

Without good natural-area examples, projects like the Edward "Ted" and Pat Jones – Confluence Point State Park could not succeed. This park caps the outermost end of an 18-mile long alluvial peninsula. The park occupies the very last firm footing and exact point where land ends beneath the sweeping currents of our continent's two greatest rivers.

In the early 1800s, this long peninsula was the "vast and most beautiful Mamelle Prairie," enthraling Timothy Flint. Explorer Zebulon Pike found "a rich prairie with small skirts of wood," while the view prompted naturalist Henri Brackenridge to exclaim of "the ocean of prairie, with islets at intervals" when overlooking the confluence from high ground near St. Charles. Collectively, the writings of several 19th century visitors describe a broad prairie-wetland plain that was frequently inundated, filled with ponds and marshes, and bordered by timber alongside the river at its furthest end and occasionally within.

The 1,118 acres at its point became a state park in 2004. Although the planners envisioned a natural floodplain reminiscent of the one Lewis and Clark saw 200 years prior, by then it had become a very large plowed field surrounded by a 10-year levee and a hydrology set by modern navigation features. In addition, the ground itself was actually fairly recent, for 200 years ago the peninsula was short enough that Lewis and Clark actually floated channels through sandbars where the park now sits.

So the restoration goal became restoring the natural vegetation (not a perfect re-creation) that reflects the examples offered by Missouri natural areas and other old-growth natural ecosystems along the Missouri and Mississippi rivers, yet recognizes the dynamic nature of floodplain ecosystems and the modern alterations. The strategy was to match the vegetation to the existing landform, soils and hydrology, and letting the hydrology follow the ebb and flow

of the Mississippi and Missouri rivers as it now exists.

Because the ground is so low, there is abundant water via seepage, backwater and periodic topping to create a diverse pattern of inundation and saturation across those 1,000 acres with their 13 feet of vertical relief (for wetlands ... that's huge!). Hills and swales associate with the more active Missouri River to the south, much different terrain and conditions than the high, flat backwater plain in the north or the deep swale between.

Soils, topography, hydrology ... the analyses came together at the park to produce maps showing current conditions to support a wide variety of riparian and wetland natural communities, reflecting examples from the above-mentioned natural areas, a 1908 plant study of the Mississippi River near St. Louis and other historical works.

Although the modern situation is different, and even the park's land is a more recent accretion, the conditions that exist on it support the basic natural communities that early explorers described. The potential vegetation model indicates conditions for a large wetland prairie with seasonal ponds on the flat plain in the north half, mesic bottomland hardwood forest on the high natural ridges alongside the Missouri River with wet-mesic and wet bottomland forests of silver maple, cottonwood, elm and willow on the intervening swales, and riverfront forests transitioning to shrub swamps and seasonal mud flats in the lowest reaches.

Despite the modern changes, we found that the park's soils and landforms matched the physical situations for nearly all of the historic natural communities.

In a partnership with the U.S. Army Corps of Engineers, which owns the north half of the park and provides major funding through its Missouri River Recovery Program, the restoration is proceeding. Several wet years have allowed the seasonal herbaceous wetlands to distinguish from the willow/



Missouri Department of Natural Resources file photo

Recent wet years have repeatedly filled seasonal water bodies throughout the park, where staff and volunteers are beginning to introduce both characteristic and conservative plant species to what will develop as marshes, sedge meadows and wet prairies.

cottonwood thickets of higher zones, and native bottomland hardwood trees are filling the highest "mesic forest" zones. Wet prairie has begun to establish on the flats, and both natural and created swales are beginning to develop marsh, shrub swamp and seasonal pond plant communities.

Several rare or highly specialized species are being grown for introduction, and much of the tree planting and introduction of conservative and less common species to prairies and wetlands is being done by local school children. This lets the restoration engage youth and community in nature and natural areas restoration and gives them an opportunity to learn about natural systems.

Is it possible to rebuild floristically complex natural systems in such an altered environment? Perhaps it is too easy to say that the situation is different now, or that the vegetation is too far gone from historic times. Certainly our most important efforts remain to seek and preserve the best remaining examples of our natural landscapes. But it is also gratifying to turn what we learn from these into other environmental projects so that they become more ecologically sound and biologically complete.

And yes, it is unusual for natural area managers to find themselves building from scratch, but it demonstrates an important natural area value: to model and teach us how to manage, restore or even rebuild sites that convey ecological complexity, functionality and natural area quality. This is likely a wave of our future, where a growing emphasis on mitigation and recovery will drive many of our conservation programs. 

Ken McCarty is the chief of the Missouri State Park System's Natural Resource Management section and current co-chair of the Missouri natural areas committee. McCarty was lead author of the confluence restoration plan and has participated in many ecosystem restoration and management projects in his 25 years with state parks.

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Missouri Department of Natural Resources file photo

School field trips are a cornerstone of the restoration program, with local students participating in the planting of local-source bottomland hardwoods into the mesic forest sites; and prairie and wetland plants into those developing communities.

Lepidoptera: preserving the diversity of Missouri's moths

Caterpillars tell us how the forest community works

By Robert J. Marquis, Ph.D.

Everyone learned the life cycle of a butterfly, most likely the monarch butterfly, when he or she was a child. The egg hatches, giving rise to the caterpillar (larva), which then pupates to form the pupa or chrysalis. Finally the adult butterfly emerges, mates, and the female lays eggs to complete the life cycle. What you may not have learned is that this life cycle applies to moths as well, and moths and butterflies together comprise the insect group called the Lepidoptera. The name Lepidoptera is a combination Greek name: lepido for scale, and pteron for wing. Moths and butterflies are unique among insects in having scales covering their wings. It is these scales that give adult Lepidoptera their color.

We focus on butterflies because they are active during the day when humans are active. In contrast most moths are active at night when we are resting. This difference belies the fact that the majority by far of all Lepidoptera are moths. And most moths are Microlepidoptera (literally, "tiny moths") as opposed to Macrolepidoptera, the cutoff being an approximate 20 mm wing span.

The fact that the adult stage of Lepidoptera is so entirely different from that of the immature or caterpillar stage results in the two stages leading entirely different lives. Adults are nectar, fruit, sap, and decomposing body feeders, or sometimes not feeding at all, whose goal it is to find a mate. The caterpillars are most frequently feeders on live plant tissue, that is, they

are herbivores. The plants of Missouri provide resources for some 2,550 species of Lepidoptera, 2,425 of which are moths, and the rest are butterflies.

And while most lepidopterists focus on adults, it is the caterpillar stage that I find to be the most fascinating. Caterpillars come in a variety of shapes and sizes, some cryptic against a leaf or bark background, or appearing similar to a twig, others brightly colored, often "warning" potential predators that they are chemically defended. Some are smooth bodied, while others are covered in hair. Many feed only at night, resting by day on a plant part other than where they feed. Some build shelters out of silk or leaves they have silked together. A few have stinging spines, but most are harmless to humans.

These insects play important roles in natural communities. Although an entomologist or naturalist would consider them to be an important part of nature, the forester may think them to be a nuisance. Most species of caterpillars feed on the leaves, and when those leaves are of trees, the caterpillars sometimes do enough damage that they reduce tree growth. Chronic (typical) levels of damage are high enough to reduce tree growth. Occasionally outbreaks occur, in which populations of a single species of caterpillars reach such high levels that complete defoliation of trees occurs over a large geographic area. Two such outbreaks of the variable oak leaf caterpillar have been recorded in the last 30 years in Missouri, resulting in defoliation of 7-8 million acres.

Not all caterpillars are leaf-feeders. Some feed on fruits and flowers, others lichens, some on fur and feathers, and wool, and some are carnivorous.

In forests, caterpillars serve as food for the very agents that likely help prevent their increase in population size. These



Photo provided by Robert J. Marquis

include insectivorous birds, parasitic insects (certain kinds of non-stinging wasps and flies), and predatory insects and spiders. Pupae serve as food for rodents, such as white-footed mice. Without caterpillars, there would be likely few or no insectivorous birds, and without caterpillars, there would be many fewer parasitic insects, who lay eggs in or on caterpillars. The egg hatches, and then the wasp or fly larva eats the caterpillar from the inside out (think of the movie *Alien*, which was inspired by this interaction). Though gruesome at first sight, these parasitic insects are probably more important in control of native Lepidoptera than birds and mice.

Caterpillars have much to tell us about how forest communities work. Bird predation on caterpillars can be sufficiently high that they actually benefit trees, through increased growth. A colleague, Dr. Christopher Whelan of the Illinois Natural History Survey, and I built net enclosures

around small oak saplings to prevent access by birds but that allowed access by insects. Trees inside enclosures were more heavily attacked by caterpillars and grew less than trees outside of enclosures.

This population control falls apart when caterpillars are introduced, either intentionally or by accident, to a new place where the native natural enemies do not attack them. The classic example is the gypsy moth caterpillar (*Lymantria dispar*), which is avoided by most birds (which often do not like hairy caterpillars) and is rarely attacked by native parasitic insects. As a result, caterpillars of the gypsy moth, which is native to Europe and Asia, have gone through widespread population outbreaks, defoliating and killing thousands of acres of trees in eastern North America over the years since its introduction in 1868. Fortunately, it has not yet established in Missouri forests.

A long-term study of the impacts of alternative timber extraction schemes, the Missouri Forest Ecosystem Project, or MOFEP, includes caterpillars on oak trees as target study organisms. Here the question is: Does forest thinning or even-aged management result in changes in abundance of these insects compared to non-harvested forests? Initial results suggest that the older the forest, the more species of moths can be found in it.

Thus to preserve the diversity represented by Missouri moths, we should set aside forest tracts that are free of timber harvest. This could include three complementary strategies: first, excluding from harvest portions of forest landscapes that otherwise are undergoing rotation harvest; second, searching out forests that are intermediate age but not old growth (+150 years) and protecting those; and finally, protecting all old growth forests (+300 years). ☘

Robert J. Marquis is the scientific director at the Whitney R. Harris World Ecology Center and a professor in the Department of Biology at the University of Missouri-St. Louis. He has studied impacts of insects on oak tree growth and diversity of insects in Missouri forests for more than 20 years, and continues similar studies in forests throughout the Neotropics, especially Brazil and Costa Rica.

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Additional resources:

<http://www.butterfliesandmoths.org/>

<http://mothphotographersgroup.msstate.edu/>

http://mofep.mdc.mo.gov/overview/default_overview.htm

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Wagner, DL. 2005. *Caterpillars of eastern North America*. Princeton University Press, Princeton, NJ.



Photo provided by Robert J. Marquis

One of the largest moths in North America, the luna moth has a wing span of 75-105 mm. They are usually found in forested areas. They generally reach adulthood from early June to early July and are primarily seen at night. Adults do not feed and are short lived, living up to a week.

Return of the Black Bears to Missouri

By Elizabeth Niven

According to many early pioneers and settlers in Missouri, black bears were found in abundance and were widely used for food as well as for their fat and skins. However, by the 1830s and 1840s, bears were rare in north Missouri, and by 1894, bears were reported to be almost extinct in the Ozarks.

In 1959, the Arkansas Game and Fish Commission quietly initiated a black bear restoration program. Since that time, the Arkansas population has expanded in both size and distribution with the present population estimated at 3,500.

Since 1959, black bear sightings have become more numerous in Missouri. Originally, it was thought that many of the bears in Missouri were migrating from the growing Arkansas population. However, recent data collected indicates that some bears in southwest Missouri are genetically unique and might be a Missouri bear population that was never completely extirpated.

To begin to solve the mystery, MDC wildlife biologists and researchers with the University of Missouri – Columbia and Mississippi State University have started a cooperative black bear research effort, funded through the U.S. Fish & Wildlife Service's Wildlife Restoration Program with help from Safari Club International. This effort will provide information about the movement patterns, population densities, habitat preferences and overall number of bears in Missouri.

The first phase was conducted in fall of 2010, when 13 bears were trapped and radio-collared in southwest and south-central Missouri. These bears were monitored over the winter to learn more about Missouri bear hibernation, including denning habits and timeframes.

Currently, biologists are using hair snares and barrel traps to trap the bears, tranquilize them and take 40 measurements and samples, which includes DNA, weight, length and other data. Again, biologists track the bear movements with radio collars.

The DNA testing will show biologists how interrelated the Missouri bear population is to the Arkansas bear population and may provide answers on where and how the population was able to survive or thrive during the years when Missouri bears were considered gone forever.

Given the sightings of the black bear population and layering that information with the locations of Missouri forests and woodlands, it isn't surprising to note that black bears are forest dwellers and live in the areas with the most contiguous forests. In fact, in many areas, wide-ranging animals such as black bears are now confined to the few remaining pockets of unfragmented landscape.



The smallest bear in North America, about 20-25 percent of black bears are actually brown in color.

In 2008, MDC developed a black bear management plan to provide guidance and continuity for black bear conservation in Missouri. This management plan, augmented with new findings from the research project, will be critical to managing Missouri's increasing black bear population.

In regards to habitat, black bears are wide-ranging animals, which need larger blocks of forest land than what most resource managers normally consider for other wildlife species. Specific habitat management for bears consists simply of providing them a stable food source with abundant mast (nuts from trees accumulated on the ground) and adequate escape cover.

Any habitat modifications that decrease mast or cover, or increase human access, will likely adversely affect bear populations. Practices that eliminate potential dispersal corridors between large tracts of timber or fall feeding grounds will likely have dramatic long-term effects on bear populations.

Forest management can enhance bear habitat by providing food and cover. Timber harvesting allows increased sunlight to the forest floor, thereby stimulating growth and fruit production of soft mast species such as blackberries, cherries, grapes, and pokeweed. Decomposing logging slash residue provides bears with a food source of insects and invertebrates. Slash piles are used as den sites and the regenerative growth provides excellent escape cover.

Detrimental effects of forest management include the conversion of oak stands to other cover types, excessive logging that greatly reduces mast production, and increased human access due to road construction. Also, if large timbered tracts are even-aged, they provide only seasonal foods and are

of lower quality.

Further, forest management for black bears in Missouri should maintain a diversity of oak species and age classes. Persimmon, sassafras, and dogwood should be protected and encouraged. Even-aged management of oak forests creates escape cover and soft mast. Clear-cut blocks should be scattered, small (fewer than 15 acres) and irregularly shaped to provide maximum edge and an overall patchy distribution of age classes.

Permanent forest openings also provide important food resources to bears and should be maintained or created in about 15 percent of the forest. Edge feathering the borders increases soft mast production and benefits bears and other species. Also, frequent prescribed fire in some habitats, such as savannas and pine woodlands, can promote berry production.

And finally, dispersal and travel corridors merit special attention. In Missouri these habitats are essential if a viable bear population is to become reestablished. Travel corridors are vital for dispersal of young-adult males, genetic interchange among populations and throughways to seasonal feeding areas. These travel corridors should be identified and protected from major disturbances. ↗

Black bears live in heavily wooded areas.



MDC

Black Bears at a glance

Family: Ursidae (bears) in the order Carnivora

Description: Largest and heaviest wild mammal in the state. They have an acute sense of hearing and smell, but relatively poor eyesight. The black bear possesses great strength and agility, and is an excellent climber, runner and swimmer.

Size: 46-78 inches. Adult males generally weigh 200 to 600 pounds and adult females weigh 100-300 pounds. Females usually smaller than males.

IQ: The black bear is highly intelligent, and its extreme wariness is an example of that intelligence.

Habitat: Black bears live in heavily wooded areas. In winter, they den in a hollow tree, cave, an excavated hollow in the ground or another shelter. In summer, they sleep in trees or on the ground.

Foods: Omnivore. Plants include grass, berries and other fruits, seeds, nuts, the inner bark of trees and roots. Animal food includes ants, bees and their honey, crickets and grasshoppers, fish, frogs, small rodents, fawns, bird eggs and many kinds of carrion. Acorns are an important food source in the fall as bears prepare for winter.

Located in Missouri: The only species of bear found in Missouri, most black bears are found south of the Missouri River.

Status: Rare and uncommon.

Reproduction: Mating is in May or June. Cubs are born in late January or February. A litter usually has two or three cubs. Cubs stay with the mother through summer and usually den with her the following winter. Black bears become sexually mature at about 3.5 years. Females produce cubs every other year until they are 18-20 years old or older.

Family dynamics: Solitary animals, except for females with cubs and during the breeding season.

Ecosystem value: Bears feed on smaller animals, keeping populations in check; they also kill old, injured or sick animals unfit to survive. As scavengers, they eat carrion and therefore help clean the woods.

Many thanks to Jeff Beringer for providing background and contributions for this article. Beringer is MDC's bear specialist and biologist. He has played a key role in the development of the bear management plan and is leading the research effort on black bear in Missouri. He can be reached at Jeff.Beringer@mdc.mo.gov, 573-802-9909, ext. 3211.

Forest birds and neotropical connections

Conserving birds and their habitats

By Brad Jacobs and Elizabeth Niven

There are 428 species of birds that have been recorded in Missouri. Of those, 335 species are present annually in Missouri. About half of those, 170 species, breed here annually. In the non-breeding season, 84 species leave Missouri, which comes to about 50 percent. And, 33 percent of the 170 species that breed annually here, which comes to 58 species, leave the United States in the non-breeding season.

Neotropical migrants would be considered part of the 58 species that leave the country. They are long-distance migrants. The others that migrate outside of the state are short-distance migrants that make up part of the migrant group minus the long-distance ones. Neotrops are found in all habitat types. Initial trouble was noticed in forest interior birds and the major concern was centered around them.

In fact, many neotropical birds have experienced extreme population declines since the '60s, when tracking bird species first started. In many cases, present day songbird populations are half of their 1965 populations. For instance, there are an estimated 14 million wood thrushes in North America, while only 40 years ago there were 28 million.

The plight of the neotropical bird in regards to forests in Missouri must be put in context. First, Missouri forests, and wildlife resources in general, have made a remarkable recovery from the early 20th century. Today, about 14 million acres of the state are covered with forests and woodland, a gain of

Prothonotary warbler



Scarlet tanager

more than 1 million forested acres in the last 20 years.

Still, forest fragmentation, which increases with land-use conversion or changes in the landscape that create a discontinuity of a particular habitat type, may play a role in the viability of certain bird population. Brood parasitism is a nesting strategy of the brown-headed cowbirds, where the female cowbird lays eggs in the nest of other host birds. The host raises the young cowbirds, often at the expense of the hosts' young.

Forest fragmentation in many areas has allowed entrance to the brown-headed cowbirds into forested habitats where many bird species don't recognize the foreign egg of the cowbird in their nest and continue to raise the cowbird as their own. Many open land and grassland bird species have been around cowbirds for millennia and will reject the eggs and toss them out of the nest. Forest birds often are not familiar with cowbird young, which hatch earlier, grow faster, and often push the young of the host out of the nest. Larger species of song birds, such as wood thrush, often raise their young and cowbirds young in the same nest.

Many warbler and vireo species often only raise cowbirds. Fragmentation, or opening of the Ozark forest and short grass patches along roads, farms and residential areas, puts the brown-headed cowbird in closer proximity to forest-breeding birds and, over time, the reduced nesting success of the forest birds will locally create population declines or complete loss of the species from the area.

The second part of the habitat-health equation is evaluating the habitat loss on the breeding and wintering grounds in Mexico, the West Caribbean and Central and South America, where our neotropical travelers may spend eight months out of 12. Much of Central America has been changing from independent farming to large-scale agriculture and non-sustainable timber harvesting. The population of Latin America and the Caribbean is on a trajectory to increase by 100 to 350 million people in the next 40 years, putting added pressure on already stressed land.

As the Missouri agency charged with conserving birds

and their habitats, the Missouri Department of Conservation (MDC) began asking critical questions years ago: Where are Missouri-breeding birds when they are not in Missouri? Are they okay where they are? How do we foster breeding success and survivorship when someone else owns the land the birds depend on?

For many decades, MDC has built conservation partnerships that link states and countries with shared bird species. These partnerships bring together federal and state agencies, non-government organizations and businesses, academia and citizens, all for the conservation of birds that ignore political boundaries. For several decades, MDC has budgeted dollars to an international partnership and tasked multiple MDC staff members to assist with long-term bird surveys, habitat management, hunting regulations development, population monitoring, field research and international education and awareness for birds that breed in Canada and winter in Missouri.

In 1993, MDC, the Mark Twain National Forest (MTNF) and the University of Missouri – Columbia (MU) submitted a proposal to the US Forest Service's International Forestry Office to establish "Sister Forest" projects between the MTNF, Missouri State Forests, MU, and the forest of El Cielo Biosphere Reserve in Tamaulipas, Mexico (El Cielo). Many bird species that breed in the oak hickory woodlands of the Missouri Ozarks are regular migrants and winter residents at El Cielo. That year, the project was not selected to receive funding, but the relationship continued.

Since the winter of 2004-2005, MDC has supported the long-term monitoring effort from November to April at El Cielo, conducted by Rafael Brito Aguilar, a doctoral student with Dr. John Faaborg at MU.

Aguilar's monitoring and research helped determine where Missouri's migrant birds spend the winter, and at which habitats and what elevations in the mountains. Sixteen mist nets are set at four sites within El Cielo Biosphere Reserve:

Ovenbird



humid tropical forest, pine-oak forests, dry oak-pine savanna, and oak-hickory cloud forests. Most of the migrants are located in the humid tropical forest and pine oaks forests. Almost no migrants are found in the cloud forest.

Are there species that have been adversely affected by conditions in MesoAmerica? MDC is trying to figure that out. Not much work has been done on this at the species level so it is ongoing and current. They have found that sensitive birds here in Missouri can switch habitats on the wintering ground. Eastern kingbirds are not tolerant of others near their nest here in Missouri but form huge flocks in winter and roost together while feeding on berries instead of insects.

Four main bird conservation initiatives are leading the science in coordinating efforts on managing habitats and learning more about species: Partners in Flight, North American Waterfowl Management Plan, US Shorebird Conservation Plan and North American Waterbird Plan. These sources help guide state and federal agencies, non-governmental organizations and industry on land-management issues, and help rank the species and habitats by priority for conservation concern.

Inevitably, certain bird species adapt better than others. If 50 percent of the species are declining and 50 percent increasing, normally it is tied to habitat change due to succession and land-use change. Bird-conservation groups and MDC are attempting to tease these concepts apart, look at them separately, and then trying to put together a species-by-species analysis.

Often there are some suites of species that can be managed as a group because it would be impossible to deal with all the species independently. This is why it is vital to coordinate management efforts. How do we roll up increases and decreases in all bird populations or even a selected group based on our efforts to manage for them? One species wins and one loses if we don't think long and hard. 

Brad Jacobs is an ornithologist and wildlife ecologist for MDC. He is the current chair of USA Partners-in-Flight's Implementation Committee and serves on the Southern Wings Task Force of the Association of Fish and Wildlife Agencies to promote on-going bird conservation projects in Latin America and the Caribbean. Jacobs is fluent in English and Spanish. After graduating with a bachelor's from Cornell University and a master's from the University of Missouri – Columbia, Jacobs volunteered with the Peace Corps and lived two years in Colombia working in the Serranía de la Macarena and El Tuparro national parks, and one year at the Darwin Research Station, Galapagos Islands, working with seabirds and teaching bird conservation in the local school system. He has authored two books: *Birding on the Navajo and Hopi Reservations* and *Birds in Missouri*; and co-authored *Missouri Breeding Bird Atlas*.

Contact: Brad Jacobs, MO Dept. of Conservation, P.O. Box 180, Jefferson City, MO, 65102, Brad.Jacobs@mdc.mo.gov, 573-751-4115 ext. 3648.

Additional resources:

www.mobirds.org

www.partnersinflight.org

August 2011

Missouri Bird Conservation Initiative Annual Conference

Columbia, Missouri

Typically a two-day meeting chock full of presentations and workshops on avian conservation in Missouri with links to larger regional, national and international bird conservation efforts. See <http://www.mobci.org/index.php> for information, or contact Gene Gardner, Gene.Gardner@mdc.mo.gov, 573-522-4115 ext. 3353 for details.

September 12-14, 2011

Grasslands in Global Context

Kansas State University, Manhattan, Kansas

An international grasslands symposium planned to celebrate important milestones reached at Konza Prairie Biological Station and the associated Konza Prairie Long-Term Ecological Research (LTER) program, the 30th and 40th anniversaries, respectively. The conference strives to develop a current, comparative synthesis of grassland/savanna ecosystems within a global framework. With the development of Konza Prairie as a global research platform in grassland studies, the stage is set for a synthesis of past, ongoing and new research results in the context of global understanding of grassland systems. Visit www.dce.k-state.edu/conf/grassland/ for more information.

September 17, 2011

Prairie Botany Workshop

Tucker Prairie, Callaway County, Missouri

Don't miss this opportunity for in-depth training with Justin Thomas, director of the Institute of Botanical Training. This one-day, 10 a.m. to 3 p.m., workshop will take place completely in the field and will focus on the dominant and characteristic plant species that are found in Missouri's prairies. Considering the time of year, special attention will be given to composites and grasses. While the ultimate goal will be to see and discuss as many species as possible, time will be spent familiarizing students with the terminology, vegetative characters and ecological notes needed to study and understand these fascinating plants beyond the scope of the workshop.

This workshop costs \$24 – a great value! Additional contributions to the Missouri Prairie Foundation are accepted. Mail checks by September 9, payable to the Missouri Prairie Foundation, P.O. Box 200, Columbia, MO 65205. Include name and contact information (e-mail and/or phone) with payment. Tucker Prairie is in Callaway County, directly south of I-70 and 2.5 miles west of the I-70 & Hwy. 54 junction. Directions and parking location will be sent to attendees. Dress for a day in the field. Bring a sack lunch and a folding chair. Questions? Call Justin Thomas, at Missouri Prairie Foundation, 317-430-6566.

September 23–25, 2011

Missouri Master Naturalist Conference

Joplin, Missouri

This annual conference of Missouri Master Naturalists (see <http://extension.missouri.edu/masternaturalist/>) promises a number of exciting natural history and outdoor education events in the Joplin area this fall. Contact Jeff Cantrell, Jeff.Cantrell@mdc.mo.gov, 417-451-4158, for information.

October 7-8, 2011

Trees

58th Annual Systematics Symposium

Missouri Botanical Garden, St. Louis, Missouri

Visit <http://www.mobot.org/mobot/research/symposium/> for symposium information.

November 1-4, 2011

Adaptation and Protection of Biodiversity in a Changing World

38th Annual Natural Areas Conference

Florida State University, Tallahassee, Florida

Plan to attend the 38th Annual Natural Areas Conference, hosted by the Natural Areas Association and National Association of Exotic Pest Plant Councils. Each year, this conference gives natural resource professionals and natural area managers the chance to connect with and learn from others working in fields related to natural area conservation. This year's conference explores a range of topics concerning natural area management and planning in the face of climate change. Tallahassee and the natural beauty of the Florida panhandle provide a stunning backdrop for the conference proceedings. Visit <http://www.naturalarea.org/11conference/> for conference information.

UPCOMING IN 2012:

February 2012 (early, usually 2-4)

Missouri Natural Resources Conference

Tan-Tar-A Resort, Osage Beach, Missouri

The upcoming conference agenda is still in the planning stages. Visit <http://www.mnrc.org/> for conference information.

February 2012 (late, usually 25-27)

Conservation Federation of Missouri 76th Annual Convention

Lodge of the Four Seasons, Lake of the Ozarks, Mo.

The agenda is still in the planning stages. Visit <http://www.confedmo.org/> for conference information.